

CLAIMS

We claim:

- [c1] 1. A system for wirelessly exchanging communications with at least one mobile unit, the system comprising:
- a first base station unit coupled to a network;
 - a second base station unit coupled to the network, wherein the first and second base station units are configured to communicate wirelessly with the mobile unit under a Bluetooth protocol;
- wherein the first and second base station units are further configured for:
- at the first base station unit, receiving a communication from the mobile unit;
 - at the first base station unit, requesting a unique session address for the mobile unit, wherein the unique address is associated with a unique Bluetooth Device Address ("BD_ADDR");
 - at the first base station unit, establishing a communications link with the mobile unit, wherein the communications link includes link context data associated with the mobile unit, and wherein the link context data associated with the mobile unit is identified at least in part based on the unique address;
 - determining that the mobile unit is to be handed-off to the second base station unit; and
 - at the first base station unit, handing off to the second base station unit the communications link and link context associated with the mobile unit.
- [c2] 2. The system of claim 1, further comprising a system controller coupled to the first and second base station units and to the network, wherein the

system controller includes a Dynamic Host Configuration Protocol ("DHCP") server, wherein requesting a unique session address includes:

- at the system controller, receiving the request,
- generating a locally unique Internet Protocol ("IP") address via the DHCP server,
- mapping the generated IP address to the unique BD_ADDR, wherein the unique BD_ADDR is a six byte value, and wherein mapping includes generating a lower three bytes of the six bytes of the unique BD_ADDR based on the generated IP address, and
- forwarding to the first base station unit the unique BD_ADDR;

wherein the first and second base station units include:

- upper and lower Bluetooth protocol stacks,
- a mobility protocol to perform generic mobility link establishing and link clearing, wherein the mobility protocol is configured to operate above a Host Controller Interface ("HCI") under the Bluetooth protocol,
- a mobility management entity, configured to operate above the HCI, for providing a protocol independent interface between the mobility protocol and the upper layers of the Bluetooth protocol stack, wherein the upper layers operate above the HCI, and
- a mobility process, configured to operate below the HCI, for interfacing between the mobility management entity and the lower layers of the Bluetooth protocol stack, wherein the lower layers operate below the HCI;

wherein the second base station is configured to determine that the communication link with the mobile unit is lost or cleared and provide a message to the system controller, and

wherein the system controller releases the unique BD_ADDR in response to the received message.

[c3] 3. The system of claim 1, further comprising a system controller coupled to the first and second base station units and to the network, wherein the first and second base station units include a radio environment management entity and a mobility protocol, and wherein at least the first base station unit is further configured for:

- monitoring a quality of the communications link with mobile unit;
- at the radio environment management entity, determining that the quality of the communications link has dropped below a threshold and generating a handoff request message;
- at the mobility protocol, receiving the handoff request message, sending a suspend message to the system controller to suspend transmissions for the mobile unit, and sending a handoff acceptance inquiry message to the mobility protocol of the second base station unit;
- receiving a response from the second base station unit;
- forwarding the link context data to the second base station unit
- exchanging primitives between the mobility protocol and the mobility management entity to clear the communications link at the first base station unit;
- at the mobility protocol, sending a link cleared message to the radio environment management entity; and
- at the mobility protocol, sending a resume data transmissions message to the system controller, wherein, in response thereto, the system controller sends data for the mobile unit to the second base station unit.

[c4] 4. In a network, a method for wirelessly exchanging communications with at least one mobile unit, wherein the network includes first and second base stations units coupled to the network, the method comprising:

- at the first base station unit, receiving a wireless communication from the mobile unit, wherein the wireless communication is under a wireless

communications protocol, wherein the wireless communications protocol does not provide for handoff of communications links between base station units;

at the first base station unit, obtaining a unique session identifier for the communication with the mobile unit;

at the first base station unit, establishing a communications link with the mobile unit, wherein the communications link includes link context data associated with the mobile unit, and wherein the link context data associated with the mobile unit is identified at least in part based on the unique session identifier;

determining that the mobile unit is to be handed-off to the second base station unit; and

handing off to the second base station unit the communications link and link context associated with the mobile unit, wherein the handing off is performed without assistance of the mobile unit.

[c5]

5. The method of claim 4 wherein the first and second base station units are both Bluetooth enabled base station units that employ upper and lower Bluetooth protocol stacks, wherein the unique session identifier is a unique Bluetooth Device Address ("BD_ADDR"), and wherein the first and second base station units include:

a mobility protocol to perform generic mobility link establishing and link clearing, wherein the mobility protocol is configured to operate above a Host Controller Interface ("HCI") under the Bluetooth protocol,

a mobility management entity, configured to operate above the HCI, for providing a protocol independent interface between the mobility protocol and the upper layers of the Bluetooth protocol stack, wherein the upper layers operate above the HCI, and

a mobility process, configured to operate below the HCI, for interfacing between the mobility management entity and the lower layers of the Bluetooth protocol stack, wherein the lower layers operate below the HCI.

[c6] 6. The method of claim 4 wherein receiving a wireless communication from the mobile unit includes receiving communication signals under a Bluetooth protocol from the mobile unit.

[c7] 7. The method of claim 4 wherein the unique session identifier is a virtual Bluetooth device address.

[c8] 8. The method of claim 4, further comprising a system controller coupled to the first and second base station units and to the network, wherein the system controller includes a Dynamic Host Configuration Protocol ("DHCP") server, and wherein obtaining a unique session identifier includes:

at the system controller, receiving a request from the first base station unit, generating a locally unique Internet Protocol ("IP") address via the DHCP server,

mapping the generated IP address to a unique BD_ADDR, wherein the unique BD_ADDR is a six byte value, and wherein mapping includes generating a lower three bytes of the six bytes of the unique BD_ADDR based on the generated IP address, and forwarding to the first base station unit the unique BD_ADDR.

[c9] 9. The method of claim 4 wherein the first base station unit or the network includes a Dynamic Host Configuration Protocol ("DHCP") function, and wherein obtaining a unique session identifier includes:

generating a locally unique Internet Protocol ("IP") address via the DHCP function, and

mapping the generated IP address to the unique session identifier.

[c10] 10. The method of claim 4 wherein the unique session identifier is a virtual Bluetooth device address having a six byte value, and wherein a lower three bytes of the six bytes of the unique BD_ADDR are generated by the first base station unit or the network and the three bytes fall within a range that is less than a total range available under the three bytes.

[c11] 11. The method of claim 4, further comprising a system controller coupled to the first and second base station units and to the network, wherein the second base station is configured to determine that the communication link with the mobile unit is lost or cleared and provide a message to the system controller, and wherein the system controller releases the unique session identifier for future use in response to the received message.

[c12] 12. The method of claim 4, further comprising generating a set of unique session identifiers before receiving the wireless communication from the mobile unit or other mobile units, wherein generating comprises:
at each base station unit in the network, locally generating at least one proposed identifier value;
transmitting the proposed value to base station units in the network;
determining whether any other base station units have generated an identical identifier value; and
if not, then storing the proposed value for use as the unique session identifier.

[c13] 13. The method of claim 4, further comprising a system controller coupled to the first and second base station units and to the network, and wherein determining that the mobile unit is to be handed-off and handing off to the second base station unit includes:
monitoring a quality of the communications link with mobile unit;

determining that the quality of the communications link has dropped below a threshold;
 sending a suspend message to the system controller to suspend transmissions for the mobile unit, and sending a handoff acceptance inquiry message to the second base station unit;
 receiving a response from the second base station unit;
 forwarding the link context data to the second base station unit
 clearing the communications link at the first base station unit; and
 sending a resume data transmissions message to the system controller, wherein, in response thereto, the system controller sends data for the mobile unit to the second base station unit.

[c14] 14. The method of claim 4 wherein determining that the mobile unit is to be handed-off and handing off to the second base station unit includes:

determining that a quality of the communications link has dropped below a threshold;
 sending a handoff acceptance inquiry message to the second base station unit;
 receiving a response from the second base station unit;
 forwarding the link context data to the second base station unit; and
 clearing the communications link at the first base station unit.

[c15] 15. The method of claim 4 wherein the first and second base station units are stationary relative to a moving vehicle.

[c16] 16. The method of claim 4 wherein the first and second base station units are stationary.

[c17] 17. The method of claim 4 wherein the unique session identifier is a active member address value selected under the Bluetooth protocol.

[c18] 18. The method of claim 4 wherein the unique session identifier is a selected clock offset value from a synchronized native clock value CLKN employed by the first and second base station units.

[c19] 19. The method of claim 4, further comprising synchronizing a clock of the first base station unit with a clock of the second base station unit.

[c20] 20. A computer-readable medium whose contents cause a fixed short-range wireless communications switch to perform a peer-to-peer method to hand-off of a communications link with a wireless mobile unit to a neighboring and fixed short-range wireless communications switch in a communications network, the method comprising:

at the fixed short-range wireless switch in the communications network, receiving a wireless communication from the wireless mobile unit, wherein the wireless communication is under a short-range wireless communications protocol, and wherein the wireless communications protocol does not provide for handoff of communications links between short-range wireless switches;

at the fixed short-range wireless switch in the communications network, obtaining a unique session identifier for the communication with the wireless mobile unit;

at the fixed short-range wireless switch in the communications network, establishing a communications link with the wireless mobile unit, wherein the communications link includes link context data associated with the wireless mobile unit, and wherein the link context data associated with the wireless mobile unit is identified at least in part based on the unique session identifier; and

determining that the wireless mobile unit is to be handed-off to the neighboring fixed short-range wireless switch; and

handing off to the neighboring fixed short-range wireless switch the communications link and link context associated with the wireless mobile unit, wherein the handing off is performed without assistance of the wireless mobile unit.

[c21] 21. The computer-readable medium of claim 20 wherein the computer-readable medium is a logical node in a computer network receiving the contents.

[c22] 22. The computer-readable medium of claim 20 wherein the computer-readable medium is a computer-readable disk.

[c23] 23. The computer-readable medium of claim 20 wherein the computer-readable medium is a data transmission medium transmitting a generated data signal containing the contents.

[c24] 24. The computer-readable medium of claim 20 wherein the computer-readable medium is a memory of a computer system.

[c25] 25. A computer-readable medium containing a data structure for use by a base station unit in a communications network, the data structure comprising:
at least one record stored at the base station unit for each communication link established with a wireless mobile unit, wherein the record comprises:
link context data associated with the communication link established with the wireless mobile unit; and
a virtual Bluetooth device address for identifying the communication link with the wireless mobile unit and the link context data, wherein the base station unit may communicate wirelessly under a Bluetooth protocol to a neighboring base station unit and the wireless mobile unit.

[c26] 26. The computer-readable medium of claim 25 wherein each record further comprises an active member address.

[c27] 27. The computer-readable medium of claim 25 wherein each record further comprises a base station unit clock offset ("CLK_OFFSET") associated with a system clock ("CLK") of the base station unit.

[c28] 28. A computer-readable medium containing a data structure for use by a base station unit in a short-range communications network, the data structure comprising:

at least one record stored at the base station unit for each communication link established with a wireless mobile unit, wherein the record comprises:

link context data associated with the communication link established with the wireless mobile unit; and

a unique session identifier for identifying the communication link with the wireless mobile unit and the link context data, wherein the base station unit may communicate wirelessly under a short-range wireless protocol to a neighboring base station unit and the wireless mobile unit, wherein the short-range wireless protocol permits the base station unit to communicate wirelessly with an effective range of less than 500 meters, and wherein the short-range wireless communications protocol does not provide for handoff of communications links between base station units.

[c29]

29. In a picocellular communications network, wherein at least one mobile unit communicates with at least a portion of the network, an apparatus comprising:

a stationary wireless network access point coupled to the picocellular communications network, wherein the base station unit includes a memory and is configured for:

receiving a wireless communication from the mobile unit, wherein the wireless communication is under a wireless communications protocol, and wherein the wireless communications protocol does not provide for handoff of communications links between stationary wireless network access points in the picocellular communications network;

obtaining a unique session identifier for the communication with the mobile unit;

establishing a communications link with the mobile unit, wherein the communications link includes link context data associated with the mobile unit, and wherein the link context data associated with the mobile unit is identified at least in part based on the unique session identifier;

determining that the mobile unit is to be handed-off to a neighboring stationary wireless network access point; and

handing off to the neighboring stationary wireless network access point the communications link and link context associated with the mobile unit, wherein the handing off is performed without assistance of the mobile unit.

[c30]

30. The apparatus of claim 29, further comprising:
a system controller coupled to the network access point;

a gateway router coupled to the system controller and the network access point, wherein the network access point forms at least a part of a first subnet;

a backbone router coupled to the gateway router and to the neighboring network access point, wherein the neighboring network access point forms at least a part of a second subnet; and

a point of presence coupled to the backbone router, wherein the point of presence and the mobile unit form at least part of a mobile unit virtual subnet.

[c31] 31. The apparatus of claim 29 wherein the unique session identifier is a virtual Bluetooth device address.

[c32] 32. The apparatus of claim 29 wherein the network access point or the picocellular communications network includes a Dynamic Host Configuration Protocol ("DHCP") function, and wherein obtaining a unique session identifier includes:

generating a locally unique Internet Protocol ("IP") address via the DHCP function, and

mapping the generated IP address to the unique session identifier.

[c33] 33. The apparatus of claim 29 wherein the network access point is further configured for generating a set of unique session identifiers before receiving the wireless communication from the mobile unit, wherein generating comprises:

locally generating at least one proposed identifier value;

transmitting the proposed value to other network access points in the picocellular communications network;

determining whether any other network access points have generated an identical identifier value; and

if not, then storing in the memory the proposed value for use as the unique session identifier.

[c34] 34. The apparatus of claim 29 wherein the network access point is stationary relative to a moving vehicle.

[c35] 35. The apparatus of claim 29 the unique session identifier is a active member address value selected under the Bluetooth protocol.

[c36] 36. The apparatus of claim 29 wherein the unique session identifier is a selected clock offset value from a synchronized native clock value CLKN employed by the first and second base station units.

[c37] 37. The apparatus of claim 29 wherein the network access point has a clock and is configured to synchronize with a clock of the neighboring stationary wireless network access point. .

[c38] 38. The apparatus of claim 29 wherein the network access point is configured to generate a first unique mobile unit ID that is associated with the session identifier, and wherein the neighboring stationary wireless network access point is configured to generate a second unique mobile unit ID that differs the first mobile unit ID, but is likewise associated with the session identifier ..

[c39] 39. The apparatus of claim 29 wherein the link context data includes values under upper Bluetooth protocol or Internet Protocol layers above a Host Controller Interface ("HCI"), and at least one lower Bluetooth protocol layers below the HCI.

[c40]

40. In a short-range wireless communications network, wherein at least one mobile unit communicates with at least a portion of the network, an apparatus comprising:

fixed means for providing short-range wireless communications within the communications network, wherein the means for providing short-range wireless communications comprises:

means for receiving a wireless communication from the mobile unit, wherein the wireless communication is under a wireless communications protocol, and wherein the wireless communications protocol does not provide for handoff of communications links between short-range wireless network nodes in the communications network;

means for obtaining a unique session identifier for the communication with the mobile unit;

means, coupled to the means for receiving, for establishing a communications link with the mobile unit, wherein the communications link includes link context data associated with the mobile unit, and wherein the link context data associated with the mobile unit is identified at least in part based on the unique session identifier;

means for determining that the mobile unit is to be handed-off to a neighboring short-range network node; and

means for handing off to the neighboring short-range network node the communications link and link context associated with the mobile unit, wherein the handing off is performed without assistance of the mobile unit.

[c41]

41. The apparatus of claim 40 wherein the means for receiving and the means for establishing include wirelessly exchanging signals under a Bluetooth protocol.

[c42] 42. The apparatus of claim 40 wherein the unique session identifier is a virtual Bluetooth device address.

[c43] 43. The apparatus of claim 40 wherein the fixed means for providing short-range wireless communications provides wireless communications under a standard protocol for a range up to about 500 meters.

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